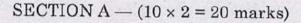
## APRIL/MAY 2024

## GPH12/DPH12 — CLASSICAL AND STATISTICAL MECHANICS

Time: Three hours

Maximum: 75 marks



Answer ALL questions.

- 1. What are constraints? Classify them.
- 2. List the properties of Poisson's bracket.
- 3. What are Action-Angle variables?
- 4. State Kepler's law.
- 5. Define moments of inertia tensor. Give its physical significance.
- 6. What do you understand from degrees of freedom?
- 7. Distinguish between first and second order phase transition.
- 8. For what kind of atoms, Sackur Tetrode formula is valid.
- 9. What is meant by idle gas?
- 10. Write a note on thermionic emission.



## SECTION B — $(5 \times 5 = 25 \text{ marks})$

Answer ALL questions.

11. (a) Prove that Poisson brackets are invariant under canonical transformation.

Or

- (b) Derive Hamilton's equations of motion.
- 12. (a) Obtain Hamilton's Jacobi equation.

Or

- (b) Discuss the theory of small oscillations and hence obtain eigen frequencies of small oscillations.
- 13. (a) Explain Euler angles and hence derive Euler's equation of motion.

Or

- (b) Write a note on (i) Precession (ii) Nutation
- 14. (a) What are ensembles? Explain different types of ensembles.

Or

(b) Explain Liouville theorem and tell its significance.

15. (a) What is Bose-Einstein condensate? Explain in detail.

Or

Discuss Pauli's theory of para magnetism

SECTION C —  $(3 \times 10 = 30 \text{ marks})$ 

Answer any THREE questions.

- Derive Lagrange's equation of motion from D'Alembert's principle
- 17. Apply Hamilton Jacobi theory to solve linear harmonic oscillator problem and hence obtain characteristic frequencies.
- 18. Describe the motion of a symmetrical top under the action of gravity.
- 19. Explain in detail about Brownian motion by Langevin theory.
- 20. Derive Planck's law of radiation and mention its limitations.

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T.V. Walai